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ABSTRACT

Based on the view that text-specific concept and vocabulary knowledge affect the processing and recall of text and that a measure of this knowledge might assist teachers in determining whether a reader possesses adequate background to successfully comprehend and recall a particular text, a study was conducted. Its purpose was to develop a measure that reflects the strength of organization of existing knowledge as it relates to key concepts and vocabulary in content area textbooks. The study elicited prior knowledge from 36 high school seniors, using free association based on stimulus content words from reading passages, categorized this knowledge into broad levels, and statistically examined the nature of the relationships between these assigned levels of prior knowledge and the organization of recall. The findings indicated that level of prior knowledge was strongly related to the recall of a passage as measured by B. J. F. Meyer's analysis of prose. In addition, it was found that the relationship among recall measures and between level of prior knowledge and the recall measures was dependent on the passages used, indicating that there was some passage dependency in terms of both prior knowledge and recall. (FL)

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PRIOR KNOWLEDGE AND ITS EFFECT ON COMPREHENSION

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A major concern among classroom teachers is that the available subject area textbooks are too difficult for their students to comprehend. However, decisions about text difficulty and projected reading performance are generally vague and often based on teacher generated assumptions regarding student knowledge of the content and vocabulary contained in a specific text. This study develops a text specific prior knowledge measure which can be used to predict the liklihood of a student's recall success before the reading of a passage.

In recent years, prior knowledge and its effect on the recall of text has become the focus of a number of research studies. Some of the findings suggest that the graphic representations depicted on a page of print are only symbols and do not, in and of themselves, carry meaning. Rather, it is the reader's prior knowledge that permits anticipation of the author's intended message and leads to comprehension and recall of text (Adams and Collins, 1979). As the reader processes the ideas represented on the page, mental associations are formed which are perceived in light of their meaning within the reader's phenomenal field and their possible integration with new ideas expressed in the text. New ideas and information are learned and retained most efficiently when relevant and related ideas are already available within the reader's memory. Prior knowledge serves a subsuming role by furnishing "ideational anchorage" during new learning experiences (Ausubel, 1968).

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A large body of research related to the organization of memory and how prior knowledge relates to comprehension and recall has been conducted. This has substantially increased our understanding of how reader/text interactions may facilitate or impede comprehension and/or recall. The organization and accessing of knowledge influences the manner in which the reader organizes the information provided by the author and the reader's organization, in turn, affects the quality of that knowledge in recall. Comprehending a text requires readers to relate the elements in the text with the characterizations in their own memory structures. Information retrieval and the recall of text are affected by the manner in which prior knowledge has been organized in memory (Anderson, Pichert and Shirey, 1977; Anderson, Reynolds, Shallert, and Goetz, 1977).

The organizational manner in which knowledge is structured facilitates the learning and remembering of information (Anderson, Spiro, and Anderson, 1978), and may provide a plan which helps readers to retrive information (Pichert and Anderson, 1977). Pearson (1979) suggests that comprehension involves the integration of new information with existing schemata. If the schemata are weakly developed, comprehension requiring the integration of new and known information is difficult. In a related study, Tannen (1979) found that anticipatory structures are based on past experience and these structures can be seen in the retelling of a passage. Further, these structures of expectation which support the processing and comprehension of stories also serve to filter comprehension and influence recall. Anderson and Freebody (1979), in their review of the role of vocabulary knowledge in reading comprehension, conclude that word

knowledge is a prerequisite for comprehension and suggest that the development of improved methods for assessing the breadth of vocabulary knowledge is needed.

This study provides a prior knowledge measure which reflects the strength of organization of existing knowledge as it relates to key concepts and vocabulary contained in content area texts. The purpose is to elicit prior knowledge using free association, to categorize this knowledge into broad levels, and to statistically examine the nature of the relationships between these assigned levels of prior knowledge and the organization of recall. This study is based on the view that text specific concept and vocabulary knowledge affect the processing and recall of text, and that a measure of this knowledge might assist teachers in determining whether a reader possesses adequate background to successfully comprehend and recall a particular text.

METHOD

Subjects

The subjects for this investigation were 36 high school seniors from a middle class suburban school district on Long Island, New York. All were college bound students enrolled in an advanced placement course in English literature.

The 36 subjects were from two classrooms. One class (n=20) were given the Cognitive Abilities Test, Form 3. Separate verbal, qualitative and nonverbal scores were generated for these subjects.

Procedure

The subjects were told that they would be asked to free associate with stimulus content words selected from two passages they would later be asked to read and recall. The selected passages were two

of the passages Meyer (1975) used in her work on the organization of prose and the structure of recall. The passage topics dealt with Schizophrenia and Parakeets, and the with-signaling target paragraph high version of each was used. This was done to provide passages which were similarly organized for "readability". Each subject was tested with both passages.

Three content words were selected from the top half of each passage structure and used as stimuli for free association. The subjects were given each content word separately and told to write anything that came to mind when they heard the word. The free association stimulus was used to access from memory knowledge related to the content word.

After the three words for a passage had been given and all free associations elicited, the subjects read the passage silently and then wrote all they could remember about the passage.

Analysis

The levels of prior knowledge assigned to the free association responses were categorized based on pilot study findings and were scored from 3 to 1 with 3 representing much prior knowledge and 1 representing little prior knowledge. Responses were related to the appropriate sub-categories as follows:

MUCH (3)- superordinate concepts, definitions, analogies, linking

SOME (2)- examples, attributes, defining characteristics

LITTLE (1)- associations, morphemes, sound alikes, first-hand experiences, no apparent prior knowledge

A fourth category entitled "no prior knowledge" had been included in the pilot study. When only 3 out of 216 recorded responses were

assigned to this category, it was decided to include this as a subcategory of "little prior knowledge". The scores for responses to each passage's three stimulus content words were averaged. Actual prior knowledge score averages ranged from 2.67 to 1.00.

The recall protocols were scored according to Meyer's text analysis categories which were based on Fillmore's (1968) case grammar and Grimes' (1972) semantic staging of propositions. One point was given for inclusion in the recall of content words, lexical predicates, role relations and rhetorical predicates. Meyer's hierarchically structured passage content was divided into thirds and items included in each of the three height levels were computed separately. The content words, lexical predicates and roles were then scored one point while the rhetorical predicates (which represented the supordinate structures) were weighted two points. Finally, a total summed recall score was computed with each of the first four variables assigned one point.

Two judges scored the prior knowledge and recall items separately. Interrater agreement revealed a relatively high percentage of agreement on the recall scores (.94) and somewhat lower on the levels of prior knowledge score (.82). In cases of disagreement, an average of the two scores was computed for the prior knowledge measure, and the decisions were negotiated for the recall analysis. A Pearson product moment correlation for all variables (level of prior knowledge, recall and I.Q.) was done on four separate sets of data: two passages each analyzed separately for classes with and without I.Q. measures (see Tables 1 and 2). The matrices for different passages for the same class were different while the matrices for the same passage from different classes were not different. As there

were no class differences, the remaining analyses were done with the two classes combined.

A principal components analysis was performed for each passage to determine the relationship between level of prior knowledge, the recall measures, and the I.Q. measures (see Tables 3 and 4). Then, a principal components analysis was performed on the content word, lexical predicate, role and rhetorical predicate measures of the recall analysis to generate a single variable which could be used as a measure of recall (see Table 5). Lastly, a set of Pearson Product Moment correlations was calculated for the I.Q. measures, the level of prior knowledge measure and the principal component score of the recall measures and the individual recall measures (see Table 6).

RESULTS

The principal components analysis on the levels of prior knowledge, I.Q. measures and recall measures for 19 subjects indicated that the I.Q. measures are a separate dimension from either level of prior knowledge or the majority of recall measures. Slightly different patterns are observed in the two passages. The Schizophrenia passage analysis resulted in three components accounting for 81% of the variability. The first component has its loadings on level of prior knowledge and the nine recall measures. The second component has verbal I.Q., quantitative I.Q. and the middle third of the response recalls. The third component has its loadings on nonverbal I.Q., lexical predicates, and the difference between the responses at the top and bottom third of the content structure. This appears to be a catch-all component which is not part of a more general pattern. The analysis of the Parakeet passage data also resulted in three components which account for 75% of the variability. The first component is again loaded on level of prior knowledge and recall, the second is on the

verbal and quantitative I.Q. measures, while the third has the nonverbal I.Q. score and the lowest third of the response recalls. From these results it can be concluded that level of prior knowledge is related to the measures of recall, and that the I.Q. measures are not related to either level of prior knowledge or recall (except at the lower levels of the content structure).

The principal components analysis for the 36 subjects' content word, lexical predicate, role and rhetorical predicate scores from the recall task indicate each of the four measures contribute equally to the overall measure. In the Schizophrenia passage, one component accounted for 72% of the variability and the scoring coefficients (not presented) ranged from .28 to .31. In the parakeet passage, the first component accounted for 79% of the variability with scoring coefficients between .25 and .30 (not presented). The component loadings are presented in Table 5.

The correlation between level of prior knowledge and the first principal component score of the four recall measures was .75 for the Schizophrenia passage and .70 for the Parakeet passage. The highest correlation with the principal component score and the I.Q. measures was -.28 for the quantitative I.Q. measure on the Schizophrenia passage and .13 for the nonverbal I.Q. measure on the Parakeet passage. These results are presented in Table 6.

DISCUSSION

Findings indicate that level of prior knowledge, as measured in this study, is strongly related to the recall of a passage as measured by Meyer's analysis of prose. This result is not dependent on the subject's I.Q. in the sense that I.Q. is not linearly

related to either level of prior knowledge or the recall measures. The prior knowledge measure, therefore, is a useful predictor of the successful recall of a specific text while I.Q. is not helpful for this purpose.

The relationship among the recall measures and between level of prior knowledge and the recall measures is dependent on the passages used. This indicates that there is some passage dependency in terms of both prior knowledge and recall. However, this dependency is most evident at the lower portions of the passage content structure. Identification of the top level superordinate structures used by the author tends to vary less with the passage and more with prior knowledge level.

These findings have interesting potential implications for classroom application in that the prior knowledge measure might be useful for teachers to use as a predictor of recall success prior to the assignment of content area textbook reading. The free association/prior knowledge measure may also assist teachers in becoming more aware of the text related levels of concept and vocabulary sophistication possessed by the individuals in the class and the group as a whole. This knowledge may be useful in helping teachers to determine when a particular textbook is inappropriate either for individuals or for the entire class. It could also assist teachers in determining whether, and for whom direct concept and vocabulary instruction is advisable.

At this point in our investigation, we know that people with higher levels of prior knowledge tend to recall passages better. We have not yet shown that altering a subject's level of prior knowledge will alter the recall of a passage. We are presently planning a quasi-intervention experiment to investigate this hypothesis.

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Table 1

Schizophrenia Passage
Correlation Among Variables
Above Diagonal for Subjects with Cognitive Abilities Test (N=20),
Below Diagonal for Subjects Without Cognitive Abilities Test (N=16)

	Level of Prior Knowledge	Content Words	Lexical Predicates	Roles	Rhetorical Predicates	Responses Top Third	Responses Middle Third	Responses Bottom Third	Total Responses Rhet. =2	Total Responses
Level P. Knowl.	1.00	.89	.73	.78	.72	.61	.53	.59	.85	.91
Cont. Wds.	.74	1.00	.51	.72	.83	.62	.65	.49	.91	.96
Lex. Preds.	.65	.63	1.00	.65	.39	.38	.23	.76	.58	.65
Roles	.47	.48	.71	1.00	.57	.45	.48	.71	.73	.82
Rhet. Preds.	.69	.44	.56	.72	1.00	.52	.64	.45	.84	.87
Resp. Top 3rd	.55	.61	.70	.35	.53	1.00	-.12	.46	.62	.60
Resp. Mid. 3rd	.28	.19	.17	.50	.49	-.05	1.00	.04	.55	.65
Resp. Bot. 3rd	.31	.33	.29	.35	.18	-.07	-.36	1.00	.61	.63
Tot. Resp. Rhet.=2	.81	.73	.77	.82	.91	.65	.45	.30	1.00	.93
Tot. Resp.	.77	.78	.83	.84	.84	.68	.43	.30	.98	1.00

Table 2

Parakeet Passage
Correlation Among Variables
Above Diagonal for Subjects with Cognitive Abilities Test (N=20),
Below Diagonal for Subjects Without Cognitive Abilities Test (N=16)

	Level of Prior Knowledge	Content Words	Lexical Predicates	Roles	Rhetorical Predicates	Responses Top Third	Responses Middle Third	Responses Bottom Third	Total Responses Rhet. =2	Total Responses
Level P. Knowl.	1.00	.70	.45	.64	.58	.56	.44	.38	.58	.39
Cont. Wds.	.77	1.00	.76	.94	.66	.69	.68	.61	.83	.65
Lex. Preds.	.68	.84	1.00	.80	.53	.52	.67	.32	.58	.72
Roles	.61	.80	.78	1.00	.60	.65	.68	.57	.77	.63
Rhet. Preds.	.73	.84	.65	.55	1.00	.51	.71	.22	.68	.72
Resp. Top 3rd	.52	.78	.66	.55	.78	1.00	.23	.20	.58	.36
Resp. Mid. 3rd	.73	.82	.68	.65	.78	.54	1.00	.27	.73	.60
Resp. Bot. 3rd	.35	.40	.50	.58	.14	.06	.03	1.00	.69	.29
Tot. Resp. Rhet.=2	.77	.97	.86	.82	.90	.80	.84	.39	1.00	.48
Tot. Resp.	.78	.98	.88	.85	.86	.79	.82	.44	.99	1.00

Table 3

Principal Component Factor Loading Pattern
for Schizophrenia Passage

Variable	Component 1	Component 2	Component 3
Level of Prior Knowledge	.93	-.11	.00
Verbal IQ	.13	.88	.20
Quantitative IQ	-.37	-.62	.16
Nonverbal IQ	.18	.38	.60
Content Words	.93	-.12	-.23
Lexical Predicates	.72	.08	.50
Roles	.86	-.13	.24
Rhetorical Predicates	.84	-.17	.20
Top 1/3 Responses	.68	.44	-.41
Middle 1/3 Responses	.56	-.72	.01
Bottom 1/3 Responses	.72	.39	.38
Total Weighted	.94	-.06	-.14
Total Responses	.98	-.14	.05
Cumulative Portion of Variability	54%	72%	81%

Table 4

Principal Component Factor Loading Pattern
for Parakeet Passage

Variable	Component 1	Component 2	Component 3
Level of Prior Knowledge	.72	.18	.16
Verbal IQ	-.06	.89	.12
Quantitative IQ	-.10	-.77	.26
Nonverbal IQ	.20	.44	.71
Content Words	.96	-.12	.06
Lexical Predicates	.81	-.24	-.26
Roles	.93	-.18	.01
Rhetorical Predicates	.79	.30	-.20
Top 1/3 Responses	.70	-.00	-.15
Middle 1/3 Responses	.79	.09	-.24
Bottom 1/3 Responses	.57	-.26	.68
Total Weighted	.88	.00	.20
Total Responses	.74	.13	-.25
Cumulative Portion of Variability	49%	64%	75%

Table 5

Principal Component Factor Loading Pattern
for Schizophrenia and Parakeet Passages

Variable	Schizophrenia Passage Loading	Parakeet Passage Loading
Content Words	.85	.96
Lexical Predicates	.80	.87
Roles	.89	.92
Rhetorical Predicates	.86	.80
Portion of Variability	72%	79%

Table 6

Correlations With First Principal Component

(Above the Diagonal are for the Schizophrenia Passage, Below are for the Parakeet)

	Level of Prior Knowledge (1)	Principal Component (2)	Total Recall Responses (3)	Verbal IQ (4)	Quantitative IQ (5)	Nonverbal IQ (6)
(1)		.75 p<.001 n=36	.74 p<.001 n=36	.03 p<.88 n=20	-.13 p<.58 n=20	.07 p<.78 n=19
(2)	.70 p<.001 n=36		.98 p<.001 n=36	.04 p<.88 n=20	-.28 p<.23 n=20	.15 p<.53 n=19
(3)	.54 p<.007 n=36	.84 p<.001 n=36		.03 p<.89 n=20	-.31 p<.19 n=20	.11 p<.65 n=19
(4)	.19 p<.42 n=20	-.11 p<.65 n=20	.02 p<.93 n=20		-.41 p<.07 n=20	.33 p<.16 n=19
(5)	-.05 p<.84 n=20	-.05 p<.83 n=20	-.20 p<.40 n=20	-.41 p<.07 n=20		-.20 p<.43 n-19
(6)	.21 p<.38 n=19	.13 p<.61 n=19	.13 p<.60 n=19	.33 p<.16 n=19	-.20 p<.43 n=19	